Final Project Report:

Stooker-

Stock Market Look Up Chatbot

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Sep.9.14

Content:

1. Introduction:

In the recent years, Artificial Intelligent(AI) has became one of the politest area of research. AI has been implemented in a range of areas such as medical diagnosis, statistics, economics. Chatbot is an application based on the Natural Language Processing(NLP). The first Chatbot, Eliza, was originated in 1966. This project is aimed to create a "Eliza styled" Chatbot. In this project, Chatbot is used to communicate stock market with the user. Because of this, Slookbo is the name given to this Chatbot. User can get information such as stock price, market value by simply type to the Slookbot, while it will response user's request in the form of natural language.

2. Techniques b.g. and implementation

A. Intent and entity recognition :

It's important for the Chatbot to distinguish the intent and entity in a sentence in order to "understand" it. Regular expressions, NLU, word vector, are all useful in such tasks. Regular expressions allows user create certain search pattern. It's useful when extracting entities with certain format such as telephone number, zipcode, Names. NLU is used to understanding the sentences by trained with large amount of data. Word vector is the techniques which quantifies a word into a multi-demention vectorm, and with the comparison of other words in the sentences, the relative relationship between each word can be calculated.In Slookbot, a combination of regular expression and Rasa nlu is used to extract entities and interpret the sentence.

The most essential for looking up stock information is to know which organization or cooperation the user is looking for. Therefore, a regular expression is created to extract the stock ticker from the message.

```python
# Use the regular expression to find the stock ticker symbol in the message
def find_ticker(message):
    ticker = None
    ticker_pattern = re.compile("[A-Z]{3,}")
    ticker = ticker_pattern.findall(message)
    return ticker
```

Figure 1. Example of regular expression used in the function

As shown in Figure 1, a regular expression *"[A-Z]{3,}"* created to represent a standard stock ticker. The function returns the name of the organization which can be used in the later of the function.

To interpret the intent of a sentence, Rasa NLU is used in Slookbot. With the help of the NLU, users can send message in different forms while Slookbot can extract the intention correctly, such as greeting, looking up for the stock price.

```
trainer = Trainer(config.load("config_spacy.yml"))
training_data = load_data('testing_dataset.json')
interpreter = trainer.train(training_data)
```

Figure 2. Example of NLU used in the function

Training dataset is imported to create the model. As user send out the message, message would be used to match the model. The function will return message's intent with its confident level.

B. Data Searching

After Slook get the entities and intentions from the message, Slook will need to look up what's user is looking for. Such process can attain by searching local database or use API. Since searching data for stocks requires up-to-date information, API method is choose for gaining the data.

```
#Get quote of the give orgnization from IEX cloud
def Gquote(ORG):
    Str=Stock('{}'.format(str(ORG)),token="{}".format(TOKEN_iex))
    quote=Str.get_quote()
    print(quote)
    return quote
```

Figure 3. Requesting Quote from IEX cloud

API searching enables Slookbot can always get the latest data. Iexfinance API is used here which provides datasets including last stock price, market value, highest/lowest price in the history, etc.

C. State Machine

Users sometimes implies the entity or the intent referring to previous messages. State Machines assigns states to each message after being interpreted. After this, Slookbot can respond to the message based on it's current state in the conversation.

```
#Three States are implemented in this project:initial,specification,final
INIT=0
SPEC=1
FIN=2
```

Figure 4. Initializing State

In application, three states are first defined, which are Initial,Specfication and Final states. Intial State is the state which user first chat with the Slookbot, and Slookbot would response with some self-introduction. After user indicate which organization to search for, Slookbot will move into Specfication state. In this state, user specify which data to look up. And then Slookbot responds to the message in Final State.

```
policy_rules = {
    (INIT, "greet"): (INIT, random.choice(responses["greeting"])),
    (INIT, "specORG"): (INIT, "What kind of quote do you want to look up?"),
    (INIT, "valuelookup"): (SPEC, random.choice(responses["valuelookup"])),
    (INIT, "volumelookup"): (SPEC, random.choice(responses["volumelookup"])),
    (INIT, "stocklookup"): (SPEC, random.choice(responses["stocklookup"])),
    (SPEC, "valuelookup"): (INIT, random.choice(responses["valuelookup"])),
    (SPEC, "volumelookup"): (INIT, random.choice(responses["volumelookup"])),
    (SPEC, "stocklookup"): (INIT, random.choice(responses["stocklookup"])),
    (SPEC, "specORG"): (SPEC, "OK, what kind of quote do you need?"),
    (SPEC, "greet"):(INIT, "Nice to meet you,what stock information do you need?"),
}
```

Figure 5. Policy rules of the state machine

Policy rule is created to navigate the conversation. Different situations are defined here so that users can chat freely with Slookbot. User can either first indicate the cooperation to look up then specify the value, or can simply message the cooperation together with the specific value to Slookbot.

D. Add Personality

As shown in Figure 6 below, A respond dictionary is created so that Slookbot can reply the message in different forms, adding some personality to itself.

```
responses = {'greeting': ["Hi, my name is Stookbot. I'm a Chatbot to help you look up stock market",
                          'Hi! How are you. Anything want to check on stock market?',
                          "Hi! I'm Stookbot. I know everything on stock market"],
```

Figure 6. Respond dictionary for random response

In the policy rules of state machine as shown in Figure 5, responses are randomly chose from the dictionary.

E. Platform

Chatbot needs to be incorporated with platform, so that users can have easy access to it. Slookbot is designed to work on Telegram, due to it's easy acceptability in Python. Also, Telegram is available in different platform such as PC, IOS, Android, MACos, etc. Shown below is an example of chatting with Slookbot on Telegram
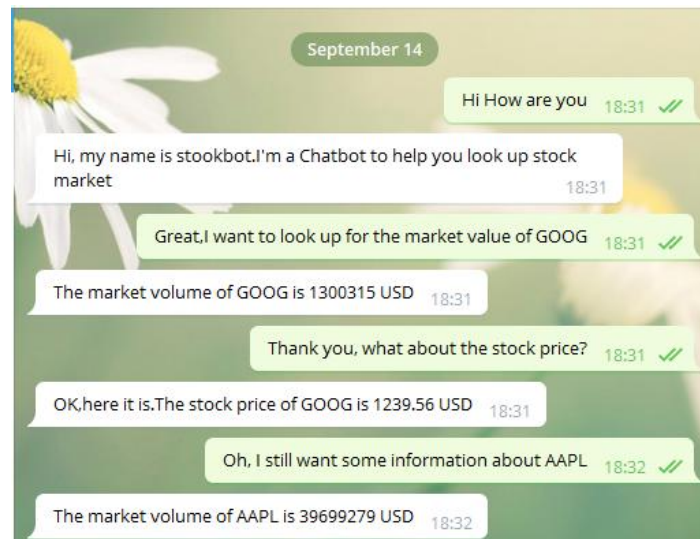
Figure 7. Example of chatting with Slookbot

3. Prospective Improvement

So far Slookbot is able to give correct data on market volume, market value and stock price with the correct given stock ticker. Certainly there is still huge capacity for Slookbot to improve.

1. Search stock ticker with the given cooperation names

Slookbot currently requires user to provide correct stock ticker, such as GOOG, AAPL, MSFT,etc.   It would be more convenient if Slookbot and match up for the stock ticker with the given company's name. For example, returning "AAPL" when user mentioned "Apple".

2. Able to return more data about a cooperation

From IEX cloud, there are much more data are provided other than just.latest market volume, market value and stock price. Slooker so far can only distinguish these three. More model can be applied in the future to distinguish more searching criteria.

4. Conclusion

Within a month of studying, a Chatbot begin with simply echoing the response is able to involve into a power stock look up Chatbot,a simple send message program into a developed program embedded with technique including entity intent recognition, API data searching, State machine. And finally incorporated with Telegram to make it available to a broad user. Even though Slookbot is not perfect in every aspect,   it has achieved a lot of progress from the beginning.